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Evaluation of Clinical Practice in Patients Admitted With Community-Acquired Pneumonia Over a 4-Year Period

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OBJECTIVE: Since March 2000 we have been using a clinical practice guideline in the management of patients diagnosed with community-acquired pneumonia (CAP). The objective of this study was to analyze the evolution of quality of care received by these patients.

PATIENTS AND METHODS: This was a prospective observational study comparing the process of care and outcomes of 4 consecutive 1-year periods (March 1, 2000 through February 29, 2004) in all patients admitted for CAP.

RESULTS: Over the 4 years studied, the following statistically significant trends were observed: reductions in hospital admissions (*P*<.001), length of hospital stay (*P*<.05), and total duration of antibiotic treatment (*P*<.05); and increases in the coverage of atypical pathogens (*P*<.001) and administration of antibiotics within 8 hours of hospital arrival (*P*<.001). No significant differences were found in readmissions within 30 days, or in-hospital and 30-day mortality. Two other areas of improvement were also identified: a low percentage of admissions to the intensive care unit (4.4%) and of unnecessary hospitalization of low-risk patients (36.8%).

CONCLUSIONS: Systematic monitoring of the indicators of our clinical guidelines provided us with information about our clinical practice and facilitated an evaluation of the same. Many of these indicators were found to have evolved favorably and areas of improvement were identified.

Key words: *Community-acquired pneumonia. Clinical guidelines. Quality indicators.*

Evaluación de la práctica clínica en los pacientes ingresados por neumonía adquirida en la comunidad durante un período de 4 años

OBJETIVO: En nuestro hospital utilizamos desde marzo de 2000 una guía clínica para el tratamiento de los pacientes diagnosticados de neumonía adquirida en la comunidad (NAC). El objetivo de este estudio ha sido analizar la evolución de la calidad del tratamiento facilitado a los pacientes ingresados por NAC.

PACIENTES Y MÉTODOS: Se ha realizado un estudio observacional prospectivo. Se compararon, en 4 períodos consecutivos de 1 año (1 de marzo de 2000 a 29 de febrero de 2004), el tratamiento y los resultados de todos los pacientes ingresados por NAC.

RESULTADOS: A lo largo de los 4 años se demostraron tendencias estadísticamente significativas en los siguientes indicadores: reducción de los ingresos hospitalarios (p < 0,001), de la duración de la estancia hospitalaria (p < 0,05) y de la duración total del tratamiento antibiótico (p < 0,05); aumento de la cobertura de gérmenes atípicos (p < 0,001) y de la administración del antibiótico en las primeras 8 h (p < 0,001). No se observaron diferencias significativas en la mortalidad intrahospitalaria, en la mortalidad en 30 días y en los reingresos en 30 días. También se identificaron 2 áreas de mejora: el bajo porcentaje de ingresos en la unidad de cuidados intensivos (4,4%) y los ingresos injustificados entre los pacientes de riesgo bajo (36,8%).

CONCLUSIONES: El control sistemático de los indicadores de nuestra guía clínica nos permitió conocer y evaluar nuestra práctica clínica. Se comprobó una evolución favorable de muchos de estos indicadores y se identificaron áreas de mejora.

Palabras clave: *Neumonía adquirida en la comunidad. Guías clínicas. Indicadores de calidad.*

Introduction

Community-acquired pneumonia (CAP), an entity associated with a high level of morbidity and mortality and significant utilization of health care resources, continues to be an important problem.[1,2] Furthermore, abundant evidence has been found demonstrating the existence of variations in clinical practice that cannot be explained by variations in epidemiology or in the characteristics of the patients being treated.[3-5] This situation has given rise to the publication in several countries of practice guidelines developed with a view to minimizing differences in the treatment and care of

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patients hospitalized with CAP and thereby improving outcomes in terms of both effectiveness and efficiency.

The implementation of a practice guideline implies the timely and appropriate application of available scientific evidence, the use of quality control indicators to monitor adherence to key recommendations, and systematic ongoing monitoring of these indicators to identify possible areas of improvement and determine to what degree target objectives are being met. The fact that a clear link has been demonstrated in patients with CAP between certain aspects of the process of care and the outcomes obtained has made it possible to define reliable quality indicators that have been accepted internationally.[6,7] The application and regular monitoring of such indicators forms the basis of any operative practice guideline, and they can also be used to further improve outcomes. In fact, several studies have demonstrated that using clinical practice guidelines to treat patients hospitalized for CAP significantly improves both quality of care and the outcomes obtained.[8-10] However, most of the studies undertaken to date have only analyzed the effect of treatment guidelines over a limited period of time.

Since March 2000, we have been using a practice guideline in our hospital to regulate and monitor the management of all patients coming to the emergency department who are diagnosed with CAP. The objective of this study was to analyze the evolution of the quality of care received by such patients over a 4-year period using internationally accepted quality indicators.[6,7]

Patients and Methods

The study was carried out in the Hospital de Galdakao, a 400-bed general teaching hospital serving a population of 300 000 located in the Basque Country autonomous region in northern Spain. This institution is one of a network of public hospitals run by the Basque health service (Osakidetza), an agency providing health care to almost 100% of the population. The doctors who work at the hospital are full-time employees and are assigned to different departments depending on their medical specialty area. The hospital also has an intensive care unit (ICU) managed by specialist personnel. The emergency department is staffed by full time physicians from various specialty areas, including family medicine.

The study was approved by the hospital research ethics committee.

Patients

This was a study of consecutive adult patients (≥18 years old) diagnosed with CAP who were admitted to the hospital between March 1, 2000 and February 29, 2004 provided that a suspected diagnosis was established within 24 hours of their arrival at the emergency department.

Pneumonia was defined as the presence of a pulmonary radiographic infiltrate not known to be preexisting and found in association with symptoms indicative of pneumonia, such as cough, dyspnea, fever, and/or pleural chest pain. Of those diagnosed with pneumonia, patients were excluded if they were infected with human immunodeficiency virus (21 cases), were immunocompromised (103 cases), or had been hospitalized within the preceding 14 days (40 cases). Immunocompromised patients were defined as those who had had solid organ transplants, were splenectomized, had been treated with at least 10 mg per day of prednisone or a similar agent for over 30 days, had been treated with other immunosuppressants, or were neutropenic (neutrophils $<1.0\times10^9$/L).

As an additional control measure, a retrospective search was made of the hospital records to identify all patients admitted during the study period who had been diagnosed with pneumonia on admission (codes 480.0-480.9, 481, 482.0-482.9, 483.0-483.8, 485, 486, 487.0, and 507.0 in the International Disease Classification, ninth revision) but were not included in our database. The patients identified in the course of this search who fulfilled the inclusion criteria of this study were then also included. These 106 additional patients were treated by doctors in the infectious diseases and internal medicine departments rather than in the pulmonology department, and treatment had been according to the criteria of the doctor in charge of their care.

Practice Guideline

The practice guideline for the management of patients with CAP described in an earlier publication was followed throughout the whole study period.[10] The 4 basic components of this guideline were as follows: *a)* the use of explicit hospitalization criteria based on severity of disease as measured by the pneumonia severity index (PSI)[11] and further refined by the application of several additional criteria[12]; *b)* prompt administration of an appropriate antibiotic in accordance with the recommendations of the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR) and the Spanish Society of Chemotherapy[13]; *c)* the definition of optimum timing for the switch from intravenous to oral antibiotics (considered to be 24 hours after the patient's mental state had returned to normal or a state similar to their baseline situation, if PaO_2 was over 90 mm Hg while breathing room air or oxygen saturation was over 90% as measured by pulse oximetry, temperature was under 30°C, hemodynamics were stable, comorbidities were under control, and intake of oral medication was possible[9]); and *d)* the establishment of discharge criteria (discharge was considered appropriate when the patient had been clinically stable for 24 hours after the switch from intravenous to oral medication and adequate home care was available).[9]

Patient Characteristics and Indicators Measured

The demographic and clinical characteristics of all the patients were recorded, as well as any prior antibiotic treatment. Severity of disease was assessed using the PSI prediction rule as defined by the original authors.[11]

The percentage of all the patients treated in the emergency department who were subsequently admitted to the hospital was calculated. The guideline was that patients in PSI risk classes IV and V should be hospitalized, while patients in risk classes I to III should only be admitted in the presence of 1 or more of the following risk factors: PaO_2 under 60 mm Hg; evidence of unstable comorbidity, pleural effusion (encapsulated and 2 cm or more on a lateral decubitus film), bilateral or multilobe radiographic involvement, intolerance of oral medication, social problems (dependent patients with no available caregiver), and poor response to prior antibiotic treatment (persistent temperature over 38°C 72 hours after start of the appropriate empiric treatment). These risk factors were selected on the basis of a critical review of the literature and the authors' judgment.

A case of CAP was defined as severe when it fulfilled at least 2 minor criteria (systolic blood pressure <90 mm Hg,

multilobe involvement, ratio of PaO_2 to fraction of inspired oxygen <250), or at least 1 of the 2 major criteria (need for mechanical ventilation and presence of septic shock).[14] Forty-nine patients whose death was an expected terminal event due to a chronic, serious, and disabling comorbidity were excluded from the calculation of the percentage of patients with severe CAP.

In both the calculation of the PSI score and the assessment of whether or not a case of CAP was severe, missing data and laboratory tests not carried out were deemed to be normal and only the results of tests carried out within 24 hours of the patient's arrival at the emergency department were taken into account.

The following treatment-related indicators were included: *a)* initial antibiotic treatment as per the SEPAR guidelines[13]; *b)* coverage of atypical pathogens (inclusion of treatment with macrolides, levofloxacin, or similar agents); *c)* initiation of antibiotic treatment within 8 hours of the patient's arrival in the emergency department; *d)* duration of intravenous antibiotic treatment; and *e)* total duration of antibiotic treatment.

The following outcomes were measured: *a)* mortality in hospital and at 30 days; *b)* mortality in-hospital and at 30 days excluding the 49 patients whose death was considered to be an expected terminal event due to a chronic, serious, and disabling comorbidity; *c)* ICU admission; *d)* use of mechanical ventilation; *e)* readmission to hospital within 30 days because of complications related to the CAP episode (2 trained pulmonologists independently reviewed all readmission records); and *f)* length of stay in hospital (calculated from the date of admission to the date of discharge). Data on mortality was extracted from both patient records and a local government database for the Basque Country providing information on vital status. Where necessary, telephone contact was also used. The 49 patients whose death was an expected terminal event due to a chronic, serious, and disabling comorbidity were excluded from the calculation of the percentage of patients admitted to the ICU who were treated with invasive mechanical ventilation.

Statistical Analysis

Frequencies, percentages, means, medians, and SD were used in the descriptive statistical analysis The χ^2 test and Cochrane-Armitage trend test were used to compare categorical variables between each of the 4 years.[15] Continuous variables were analyzed using the Kruskal-Wallis nonparametric test and analysis of variance (applying Scheffé's method in multiple comparisons).

Trends were analyzed using linear regression, and adjusted analyses were used to analyze mortality and readmission at 30 days, in-hospital mortality, and length of stay in hospital. The main independent variable in the adjusted models was the year studied (years 1 to 4) with the first year as a reference group. Logistic regression modeling was used to analyze the dichotomous dependent variables (in-hospital mortality and readmission at 30 days). Length of stay in hospital was analyzed using the general linear model. Since the distribution of these variables was not normal, a logarithmic transformation was applied. Parameter estimates and standard errors are presented after exponentiation. All models were adjusted for severity (measured using the continuous PSI scale), multilobe involvement on chest radiograph, and antibiotic treatment prior to hospital admission; Statistical significance was set at *P* less than .05. The statistical analysis was carried out using the SAS statistical package, version 8.0 for Windows.

Results

The study included 1206 patients (277, 311, 310, and 308 respectively in the 4 years) who had been admitted to the Hospital de Galdakao with CAP. In the calculation of the PSI, the percentage of missing data did not exceed 1% for any variable.

Disease severity and the demographic and clinical characteristics of the patients did not vary greatly during the 4-year study (Table 1). Significant

TABLE 1
Demographic and Clinical Data for All Patients Hospitalized With Community-Acquired Pneumonia Over 4 Consecutive Years*

Characteristics	Year 1 (n=277)	Year 2 (n=311)	Year 3 (n=310)	Year 4 (n=308)	*P*	Total (n=1206)
Demographic data						
Age (SD), y	70.9 (16.7)	70.5 (16.1)	71.3 (16.2)	72 (15.7)	.71	71.2(16.1)
Age <50 y	34 (12.3)	40 (12.9)	44 (14.2)	32 (10.4)	.55	150 (12.4)
Female	101 (36.5)	104 (33.4)	106 (34.2)	114 (37)	.75	425 (35.2)
Nursing home resident	31 (11.2)	26 (8.4)	25 (8.1)	31 (10.1)	.52	113 (9.4)
Prior antibiotic treatment	57 (22.9)	60 (19.5)	66 (21.6)	53 (17.3)	.36	236 (20.2)
Number of concomitant diseases						
1	121 (43.7)	117 (37.6)	111 (35.8)	113 (36.7)	.20	462 (38.3)
≥2	51 (18.4)	76 (24.4)	72 (23.2)	65 (21.1)	.31	264 (21.9)
PSI risk class†						
Class I	27 (9.8)	33 (10.6)	35 (11.3)	34 (11)	.93	129 (10.7)
Class II	30 (10.8)	30 (9.7)	30 (9.7)	29 (9.4)	.94	119 (9.9)
Class III	71 (25.6)	82 (26.4)	61 (19.7)	63 (20.5)	.11	277 (23)
Class IV	97 (35)	108 (34.7)	129 (41.8)	123 (39.9)	.19	457 (37.9)
Class V	52 (18.8)	58 (18.7)	54 (17.5)	59 (19.2)	.96	223 (18.5)
PSI score, mean (SD)	98.6 (37.3)	98.5 (36.3)	100.3 (36.6)	100.2 (36.8)	.88	99.4 (36.7)
Severe CAP‡	30 (11.4)	32 (10.8)	25 (8.6)	30 (10.1)	.72	117 (10.2)

*Values are shown as number (percentage) unless otherwise indicated. Percentages exclude patients with missing data. PSI indicates pneumonia severity index; CAP, community acquired pneumonia.
†Severity was measured using the PSI. Patients in class I have the lowest severity and risk of death, and those in class V, the highest.
‡Severity was defined as the presence of at least 2 minor findings (systolic blood pressure <90 mm Hg, multilobe involvement, PaO_2 /fraction of inspired oxygen <250) or at least 1 of 2 major findings (need for mechanical ventilation and presence of septic shock); 49 patients whose death was considered to be an expected terminal event due to a chronic, serious, and disabling comorbidity were excluded.

differences were, however, found in 2 variables: history of chronic obstructive pulmonary disease (*P*=.03) and hematocrit values (*P*=.02). The mean (SD) age of the patients admitted over the 4 years was 71.2 (16.1) years, and mean severity of disease as measured by the PSI was 99.4 (36.7) points.

In an analysis of all the patients (both inpatients and outpatients) who came to the emergency department, no significant differences were found between the 4 study periods in the percentage of patients belonging to the PSI low risk categories (classes I-III; 64.4%, 62.2%, 59.7%, and 65.7% in years 1 to 4, respectively; *P*=.22).

Table 2 shows a comparison of the percentage of patients hospitalized each year during the study. Statistically significant downward trends were observed in the percentage of all patients admitted to hospital (*P*<.001) and in the percentage of patients in low risk classes hospitalized (PSI classes I-III) (*P*<.001). However, it was observed that even in the final year of the study there was no apparent justification for the hospitalization of 34.9% of the patients belonging to PSI classes I to III who were admitted.

Table 3 shows the results of a comparison of the treatment regimens used in each of the 4 years of the study. The use of appropriate antibiotic treatment remained above 88% throughout the study. A statistically significant increase was found in the coverage of atypical pathogens (*P*<.001) and in the initiation of antibiotic treatment within 8 hours of arrival at the emergency department (*P*<.001). The duration of antibiotic therapy also decreased significantly (*P*<.05), and the duration of intravenous treatment went from 3.4 days in the first year to 3.2 in the fourth (*P*<.01).

The different types of antibiotics used are shown in Table 4. The data reveal a growing trend towards treatment with the new quinolones (*P*<.001) and a decrease in both single-drug treatment with β-lactam antibiotics (*P*<.001) and regimens combining a β-lactam antibiotic and a macrolide (*P*<.001).

A comparison of the 4 years did not reveal any significant differences in important indicators, such as mortality at 30 days, in-hospital mortality, ICU admission, or need for mechanical ventilation (Table 5). Moreover, adjusted analyses failed to demonstrate any

TABLE 2
Comparison of the Numbers of Patients Hospitalized Each Year During the 4-Year Study*

	Year 1	Year 2	Year 3	Year 4	*P*	Total
All Patients	418	447	472	545		1882
Patients hospitalized	277 (66.3)	311 (69.6)	310 (65.7)	308 (56.5)	<.001	1206 (64.1)
Patients at low risk (PSI classes I-III)	269	278	281	358		1186
Patients hospitalized†	128 (47.6)	145 (52.2)	126 (44.8)	126 (35.2)	<.001	525 (44.3)
Patients hospitalized for no apparent reason‡	51 (39.8)	54 (37.2)	44 (34.9)	44 (34.9)	.37	193 (36.8)

*Data are expressed as number (percentage). Including both hospitalized patients and outpatients. The *P* values refer to the analysis of the trend over the 4 years. PSI indicates pneumonia severity index.
†Percentage of all patients at low risk. ‡Percentage of patients at low risk admitted to hospital.

TABLE 3
Comparative Analysis of the Treatment Regimens Used in Hospitalized Patients Over the 4 Years of the Study*

Treatment	Year 1 (n=277)	Year 2 (n=311)	Year 3 (n=310)	Year 4 (n=308)	*P*	Total (n=1206)
Appropriate antibiotic treatment†	243 (88.4)	277 (90.2)	283 (92.8)	281 (92.1)	.07	1084 (90.9)
Coverage of atypical pathogens‡	160 (57.8)	186 (59.8)	221 (71.3)	243 (78.9)	<.001	810 (67.2)
Antibiotic within 8 hours	146 (60.6)	189 (67)	223 (80.2)	254 (87.3)	<.001	812 (74.4)
Duration of antibiotic treatment, mean (SD), d[a]	11.6 (3.9)	11.6 (4.6)	11.5 (4.5)	10.7 (3.2)	<.05	11.3 (4.1)
Duration of intravenous treatment, mean (SD), d[a]	3.4 (2.8)	3.4 (4.5)	3.2 (3.4)	3.2 (3.1)	.25	3.3 (3.5)

*Values are number (percentage) unless otherwise indicated. Percentages exclude patients with missing data. The *P* values refer to the analysis of the trend over the 4 years.
†Appropriate antibiotic treatment was defined as the regimen recommended in the guidelines of the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR).
‡Coverage for atypical pathogens was defined as being an antibiotic treatment including a macrolide or a quinolone.
[a]Patients who died in the hospital were excluded.

TABLE 4
Antibiotics Used to Treat the Hospitalized Patients Over the 4 Years of the Study*

Treatment	Year 1 (n=277)	Year 2 (n=311)	Year 3 (n=310)	Year 4 (n=308)	*P*	Total (n=1206)
β-lactam antibiotic alone	101 (36.7)	115 (37.5)	74 (24.3)	58 (19)	<.001	348 (29.2)
β-lactam antibiotic plus macrolide	50 (18.2)	34 (11.1)	19 (6.2)	22 (7.2)	<.001	125 (10.5)
New quinolones alone or in combination	90 (32.7)	137 (44.6)	196 (64.3)	216 (70.8)	<.001	639 (53.6)
Others	34 (12.4)	21 (6.8)	16 (5.3)	9 (3)	<.001	80 (6.7)

*Data are expressed as number (percentage). Percentages exclude patients with missing data. The *P* values refer to the analysis of the trend over the 4 years.

significant differences between the 4 study periods in mortality or readmission at 30 days or intrahospital mortality. The mean age of the patients admitted to the ICU during the study was 62.2 years. Of the patients over 64 years hospitalized for CAP, 3.2% were admitted to the ICU. Mortality in the group of patients admitted to the ICU was 14%, and no significant differences were observed when the 4 years were compared (*P*=.029).

A statistically significant reduction was observed in mean length of stay in hospital (*P*<.05), with a decrease of 0.8 days between the first and the fourth year (Table 5). Adjusted analysis of length of stay in hospital revealed a progressive decrease over the 4 years: 5.1 days in the first year, 4.8 in the second, 4.4 in the third, and 4.1 in the fourth. The differences observed between the first year and the third and fourth years were statistically significant (*P*<.001).

Discussion

The implementation of a practice guideline for the management of patients diagnosed with CAP involved planning the care of such patients in accordance with current scientific evidence and monitoring adherence to the guideline by way of established indicators. Consequently, we were able to identify areas susceptible to improvement and take the necessary corrective measures. During the 4-year study we observed an improvement in indicators related to quality of care, including reductions in the number of admissions and the length of hospital stay.

Our study had several strengths. The first was the innovative design that provided data on improvements in quality indicators after the guideline was implemented. Other key components were the use of internationally recognized quality indicators and the fact that the study covered 4 consecutive years and prospectively included patients admitted to a general teaching hospital for CAP who met the inclusion criteria.[6,7]

In another study published recently, our group demonstrated—using a pre-post intervention design incorporating an external control group—that the application of a clinical practice guideline improved quality of care and outcomes in patients hospitalized for CAP.[10] The present study, undertaken to analyze the impact of ongoing adherence to a practice guideline, found that the improvements described in the earlier study were surpassed not only in the quality of care received, but also in the length of stay in hospital.

The decision whether or not to hospitalize a patient—a key factor in the management of CAP–is based on the severity of the patient's condition and depends on the physician's clinical judgment. This situation gives rise to the variations observed between different hospitals and countries in the percentage of patients hospitalized. For example, the proportion of adults diagnosed with CAP who are admitted to hospital ranges from 12%[16] to 79.6%[17] in Spain; from 22%[18] to 42%[2] in the United Kingdom; from 15%[19] to 41%[20] in the United States of America; and in a study carried out in Finland was 42%.[21] It seems very likely that the underlying cause of this variability is the lack of a rule for making admissions decisions that would definitively categorize patients into risk groups. In our hospital, the PSI fine tuned by the addition of several supplementary criteria was used as a guide, allowing us to identify low-risk patients who did not need hospital care and whose admission was discretionary,[12] thereby reducing the percentage of patients hospitalized from 66.3% in the first year to 56.5% in the fourth year. Even so, in over 30% of the low-risk patients admitted during the 4-year period, the reasons for hospitalization were not apparent.

The length of stay in hospital, which depends on the time it takes for the patient to become clinically stable, has considerable economic impact,[22,23] and it has been shown that reductions in this variable have no significant effect on clinical outcomes.[3,4] In our study, as in others,[8-10] the mean adjusted length of stay in hospital decreased, going from 5.1 days in the first year

TABLE 5
Comparative Analysis of Outcomes in Patients Hospitalized During the 4-Year Study*

Outcomes	Year 1 (n=277)	Year 2 (n=311)	Year 3 (n=310)	Year 4 (n=308)	*P*	Total (n=1206)
Mortality						
At 30 days	29 (10.5)	33 (10.6)	40 (12.9)	35 (11.4)	.55	137 (11.4)
In-hospital	21 (7.6)	27 (8.7)	35 (11.3)	29 (9.4)	.29	112 (9.3)
Mortality†						
At 30 days	16 (6.1)	19 (6.4)	22 (7.5)	24 (8.1)	.29	81 (7)
In-hospital	12 (4.6)	15 (5.1)	17 (5.8)	18 (6.1)	.38	62 (5.4)
ICU admission†	12 (4.6)	18 (6.1)	9 (3.1)	11 (3.7)	.29	50 (4.4)
Invasive mechanical ventilation†	5 (1.9)	6 (2)	5 (1.7)	6 (2)	.98	22 (1.9)
Readmission within 30 days	7 (2.5)	9 (2.9)	8 (2.6)	11 (3.6)	.51	35 (2.9)
Length of stay in hospital, d‡						
Mean (SD)	5.7 (3.8)	6 (6.3)	5.5 (4.8)	4.9 (4.3)	<.05	5.5 (4.9)
Median	5	5	4	4	<.001	4
≤3 days	71 (27.7)	100 (35.2)	119 (43.3)	122 (43.7)	<.001	412 (37.7)

*Values are number (percentage) unless otherwise indicated. The *P* values refer to the analysis of the trend over the 4 years. ICU indicates intensive care unit.
†Excluding patients whose death was considered to be an expected terminal event due to a chronic, serious, and disabling comorbidity.
‡Excluding patients who died in the hospital.

to 4.1 in the fourth ($P<.001$). Our results indicate that a considerable number of patients, including those in the high-risk classes (PSI classes IV and V), reached clinical stability very quickly. This facilitated an early switch from intravenous to oral administration of antibiotic therapy followed by discharge from hospital in the following 24 hours. In our opinion it is unlikely that this reduction in length of stay in hospital was associated with clinical instability after discharge because no significant increase was found in readmissions or mortality at 30 days.[24] Moreover, the mean duration of intravenous antibiotic therapy and of length of stay in hospital in our study coincided with results obtained in earlier studies.[25,26]

Antibiotic regimens changed a great deal over the 4 years. Although most patients were treated with antibiotics in accordance with SEPAR guidelines,[13] a significant increase was observed in the coverage of atypical pathogens based on increased use of the new quinolones. The percentage of patients who received antibiotic treatment within 8 hours of arrival increased significantly. This change is particularly important because of the positive correlation between this variable and favorable clinical outcomes.[27,28] Both the duration of intravenous antibiotic treatment and the total duration of treatment were also reduced. Although it was not one of the objectives of the study to establish links between process of care and outcomes, it is nonetheless highly likely that the reduction in length of stay in hospital is associated with the improvements observed in the use of antibiotic treatment.[7,28,29]

Some 4% of all the patients studied were admitted to the ICU, and this proportion, which remained constant throughout the 4-year period, is similar to that found in certain other studies,[30,31] although lower than the figure reported elsewhere.[32] Considerable variation has been demonstrated in this variable because the decision to admit a patient to the ICU is a subjective one that depends on the intensivist's clinical judgment and is conditioned by local patterns of behavior, institutional policies, and structural differences between hospitals.[32] Although no good indicator exists that can be used to assess whether or not a patient should have been admitted to the ICU, we were able to identify the following data that suggest inappropriate use of intensive care facilities during the study period: the percentage of patients classified as having severe CAP was over 6 points higher than the percentage of patients admitted to the ICU during the 4 years; the mean age of the patients admitted to the ICU was lower than the figure reported in other studies[14,33]; and mortality among patients admitted to the ICU was low.[32] It would, therefore, appear that the criteria for ICU admission should be adjusted in order to close the gap between our results and the reference indicators reported in the literature, thereby improving future outcomes.

The study had several limitations. Since this was an observational study with no external control group, we cannot demonstrate that the improvements observed were not simply a long-term trend rather than a direct result of the implementation of a practice guideline and/or the systematic monitoring of quality indicators. In hospitals in the USA—a highly competitive environment—it has been shown that changes observed in treatment practices and the decrease in the length of stay in hospital were due to long term trends rather than the implementation of a clinical practice guideline.[34-36] However, in a study of the management of patients admitted with CAP to several hospitals in the Basque Country autonomous community in northern Spain, no relevant changes over time were observed.[37] It is, therefore, more likely that the improvements observed in our study were the result of ongoing adherence to a clinical practice guideline rather than part of a general trend.

In conclusion, systematic monitoring of quality indicators in patients diagnosed with CAP provided us with information about our clinical practice and facilitated an evaluation of the same. We observed an improvement in the use of antibiotics and a reduction in both the percentage of patients hospitalized and the adjusted mean length of stay in hospital. Two other areas for improvement were also identified: unnecessary hospitalization of low-risk patients (PSI I-III), and the criteria for admission to the ICU.

The use of a practice guideline and systematic monitoring of the indicators that underpin such recommendations should become routine practice for clinicians. This would make possible systematic assessment of the quality of our clinical practice, monitoring of variability, and comparison with the best models available.[6]

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